



**Future Technology Devices
International Ltd.**

**ANVNC1L-01 Vinculum VNC1L
Bootloader**

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1 Vinculum VNC1L Bootloader

This document describes the commands available for communicating with the VNC1L device's bootloader and how to use them.

A chapter is also included on how to interface to the Vinculum VNC1L device UART for reprogramming the Flash memory using the bootloader.

2 VNC1L Bootloader Commands

2.1 Set Data Variables

Command Bytes

0x01,
 TimerLow,
 TimerHigh,
 Baud1,
 Baud2,
 Baud3

Response Bytes

0x02

Remarks

This command allows the Flash program time and Baud rate to be specified. A value of 6000 (0x1770) should be used for the program time (*TimerLow* = 0x70 and *TimerHigh* = 0x17). The Baud rate should be specified according to the table below. A value of 1MBaud gives fast and reliable Flash programming (*Baud1* = 0x03, *Baud2* = 0x00, *Baud3* = 0x00). The bootloader defaults to a Baud rate of 115200.

Baud Rate Table

Baud Rate	Baud1	Baud2	Baud3
300	0x10	0x27	0x00
600	0x88	0x13	0x00
1200	0xC4	0x09	0x00
2400	0xE2	0x04	0x00
4800	0x71	0x02	0x00
9600	0x38	0x41	0x00
19200	0x9C	0x80	0x00
38400	0x4E	0xC0	0x00
57600	0x34	0xC0	0x00
115200	0x1A	0x00	0x00
230400	0x0D	0x00	0x00
460800	0x06	0x40	0x00
921600	0x03	0x80	0x00
1000000	0x03	0x00	0x00
1500000	0x02	0x00	0x00
2000000	0x01	0x00	0x00
3000000	0x00	0x00	0x00

Note: Baud rates in gold cannot be used for Flash programming due to the time required to write to the Flash memory. 1000000 Baud (1MBaud) is the fastest Baud rate that should be used for Flash programming.

2.2 Read Flash Block

Command Bytes

0x02,
FlashAddressLow,
FlashAddressHigh,
Count

Response Bytes

0x02
Data Block Read

Remarks

This command reads *Count* bytes from the Flash memory starting at the address given by the Flash address word which can be calculated as follows:

$$\text{Flash Address} = ((\text{FlashAddressHigh} \text{ shifted left } 8) \text{ OR } 0xFF) \text{ AND } \text{FlashAddressLow}$$

For example, to read a Flash address of 0xABCD the values to be sent in the command would be *FlashAddressHigh* = 0xAB and *FlashAddressLow* = 0xCD.

A *Count* value of 128 bytes should be used.

2.3 Write Flash Block

Command Bytes

0x03,
FlashAddressLow,
FlashAddressHigh,
Count (Followed by a response of 0x02)
Data Block to Write

Response Bytes

0x02 after command (after *Count* sent)
0x02 after data block sent

Remarks

This command writes *Count* bytes to the Flash memory starting at the address given by the Flash address word which can be calculated as follows:

$$\text{Flash Address} = ((\text{FlashAddressHigh shifted left 8}) \text{ OR } 0xFF) \text{ AND } \text{FlashAddressLow}$$

For example, to write a Flash address of 0xABCD the values to be sent in the command would be *FlashAddressHigh* = 0xAB and *FlashAddressLow* = 0xCD.

A *Count* value of 128 bytes should be used.

2.4 Echo

Command Bytes

0xFF OR 0xFA

Response Bytes

0xFF OR 0xFA

Remarks

This command is echoed by the VNC1L bootloader. If 0xFF is sent, it returns 0xFF. Similarly, if 0xFA is sent then 0xFA is returned. These commands can be used to synchronise to the bootloader before programming the Flash.

3 VNC1L Bootloader Pseudo Code

A simplified VNC1L programming application outline is provided below, not taking account of error recovery.

A VNC1L programming application should perform the following steps:

- Initialise programmer UART with the following characteristics:
 - Baud rate: 115200
 - Data bits: 8
 - Stop bits: 1
 - Parity: None
 - Handshaking: RTS/CTS
- Synchronise the programmer and VNC1L
 - LOOP**
 - Send an [Echo](#) command (0xFF)
 - Wait for a response
 - Read bytes available
 - UNTIL** last byte received is the [Echo](#) response (0xFF)
 - Send alternative [Echo](#) command (0xFA)
 - LOOP**
 - Check for data available
 - If data available, read it. Otherwise wait for data
 - UNTIL** Last byte received is the [Echo](#) response (0xFA)
 - If last byte received was the alternative [Echo](#) response, then synchronisation complete
 - If last byte received was not the alternative [Echo](#) response, repeat synchronisation
- Set desired VNC1L Baud rate and timer value of 6000 using the [Set Data Variables](#) command
- Set programmer UART to the same Baud rate as the VNC1L
- Program flash from file
 - LOOP**
 - Read a block of data from the firmware ROM file
 - Send [Write Flash Block](#) command for *Count* bytes (128 bytes required)
 - Wait for acknowledgement (0x02)
 - Write the block of data to the VNC1L
 - UNTIL** the complete firmware file has been written to the Flash memory
- Verify the Flash contents
 - LOOP**
 - Read a block of data from the firmware ROM file
 - Send the [Read Flash Block](#) command requesting *Count* bytes (128 bytes required)
 - Wait for acknowledgement (0x02)
 - Wait for *Count* bytes to be returned
 - Compare the data from the ROM file and the Flash memory
 - If they do not match, flag an error
 - UNTIL** the entire firmware file has been compared to the entire Flash memory **OR** an error was found
- Flash programming complete

4 VNC1L Bootloader Hardware Interface

The Vinculum VNC1L bootloader uses the UART interface to load new firmware into the Vinculum Flash memory. The UART can be interfaced to in the following ways:

- [Using an FTDI USB-serial device](#)^[9]
- [Using a legacy COM port](#)^[11]
- [Using a microcontroller with a UART](#)^[12]

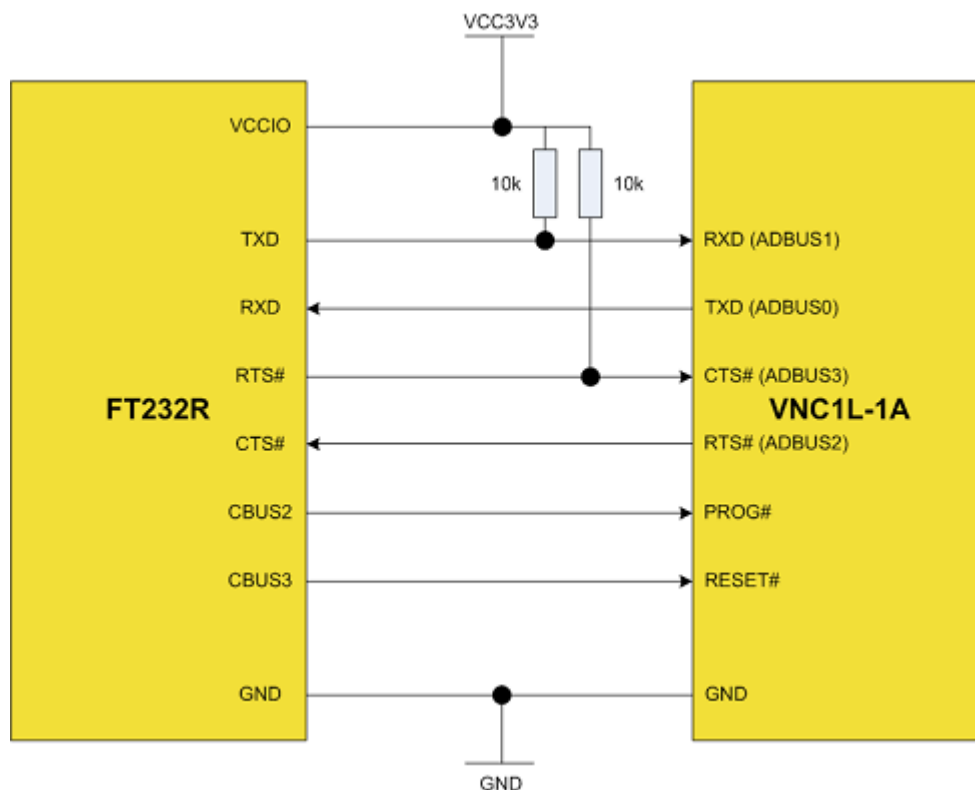
4.1 VNC1L Programming Over USB

The [VNC1L](#) device can be programmed from a PC USB port using an FTDI USB-serial converter device such as the [FT232R](#), [FT232BM](#) or [FT8U232AM](#). This is the fastest way to reprogram the VNC1L Flash memory as data can be transferred to the Vinculum device at up to 1MBaud.

The [MM232R](#) and [UM232R](#) provide a convenient way of interfacing the [FT232R](#) to a Vinculum [VNC1L](#) design or the [VDIP1](#) evaluation module and will allow for programmatically controlling the state of the PROG# and RESET# pins.

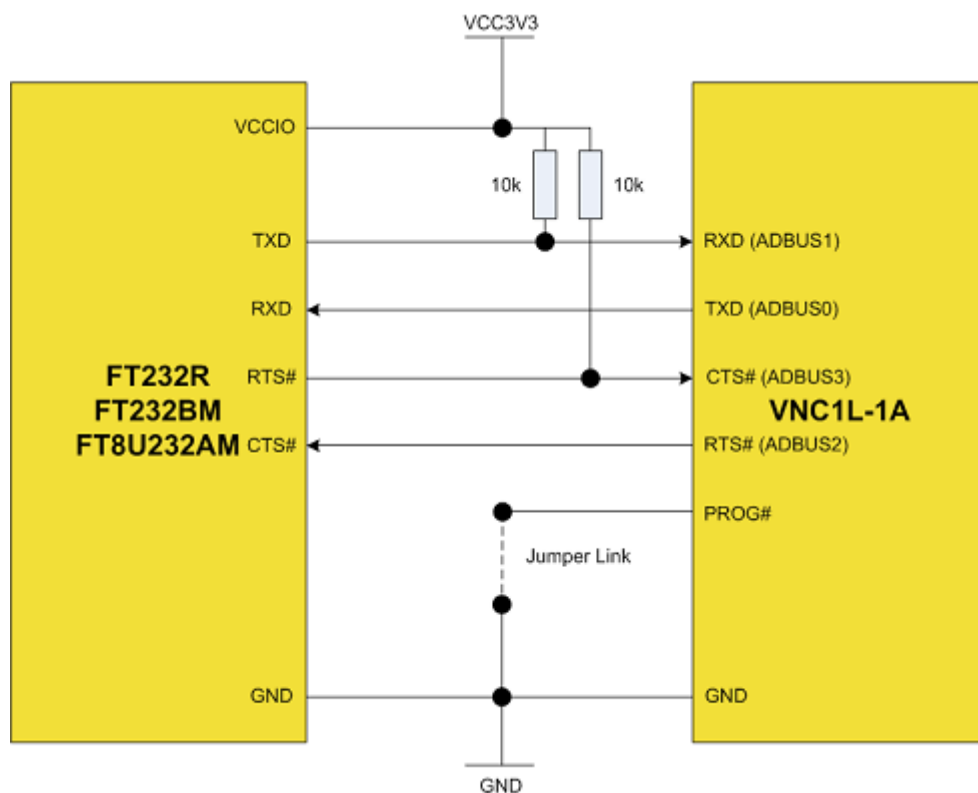
FTDI's standard Vinculum evaluation kits ([VDRIVE1](#), [VMUSIC1](#), [VF2F](#)) all have a 6-pin header which can be interfaced to the [FT232R](#)-based [TTL-232R-3V3](#) cable to allow firmware reflashing and require a jumper to be set to enable the bootloader at power up.

The required connections between the VNC1L and an FT232R device for programmatically controlling the PROG# and RESET# pins is shown below:



Note that CBUS Bit Bang mode must be enabled in the FT232R EEPROM for CBUS2 and CBUS3 for this to function (see [AN232R-01 Bit Bang Modes for the FT232R and FT245R](#) for details of CBUS Bit Bang mode). To enable the bootloader, the PROG# pin must be driven low and the VNC1L must then be reset by driving the RESET# pin low then high. Run mode can be enabled by driving the PROG# pin high and then resetting the VNC1L by driving the RESET# pin low then high.

If using an FT232BM, FT8U232AM or an FT232R without using CBUS bit bang on CBUS2 and CBUS3 to programmatically control the PROG# and RESET# pins, a jumpered configuration is required as follows:



Note that for the bootloader to be active the jumper must be fitted before powering the VNC1L. If the jumper is not fitted, the VNC1L will power up in run mode with the bootloader inactive.

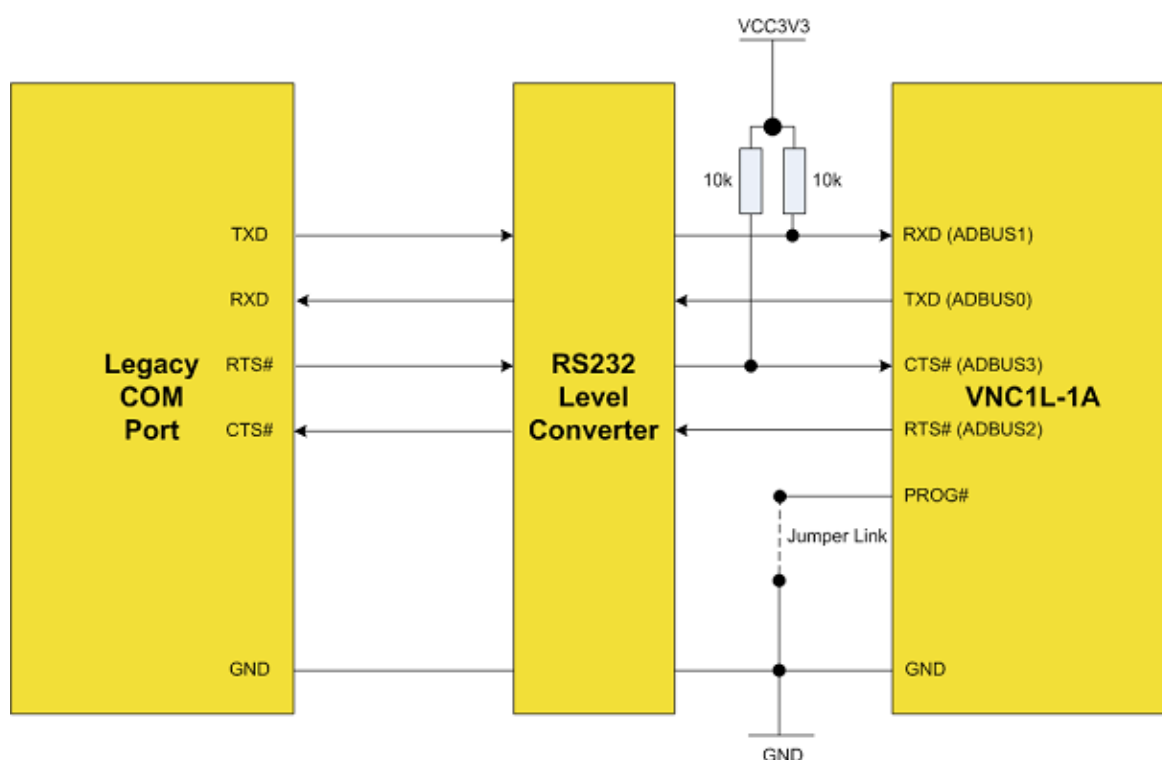
Both of the configurations above are supported by the [VPROG application](#) which can be downloaded from the [Vinculum web site](#).

4.2 VNC1L Programming From a COM Port

It is possible to program firmware into the VNC1L using a legacy PC COM port, provided that the COM port to be used is capable of at least 115200 Baud. This is required because the VNC1L bootloader defaults to 115200 Baud. The Baud rate may be changed by issuing a [Set Data Variables](#) ^[3] command to the VNC1L after establishing communication at 115200 Baud.

Programming the VNC1L device using a legacy COM port requires the use of an RS232 level converter on the UART of the VNC1L to convert between the RS232 signal level and the VNC1L 3.3V level (5V safe). In addition, a jumper has to be fitted to the PROG# pin of the VNC1L to allow for switching between program mode and run mode. Note that for the bootloader to be active the jumper must be fitted before powering the VNC1L. If the jumper is not fitted, the VNC1L will power up in run mode with the bootloader inactive.

A sample block diagram of the hardware requirements for programming from a legacy COM port is shown below:



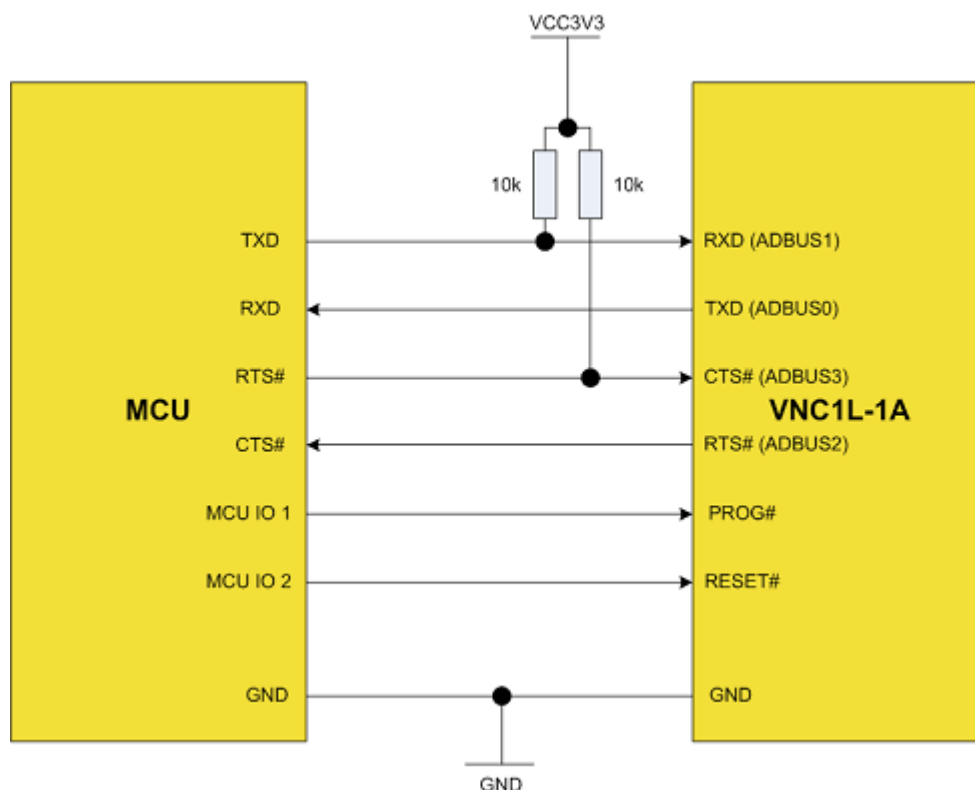
At present, programming from a legacy COM port will require software development to create a Flash programming application.

4.3 VNC1L Programming From an MCU

VNC1L firmware can also be updated via a microcontroller with a UART. The microcontroller must be capable of at least 115200 Baud. This is required because the VNC1L bootloader defaults to 115200 Baud. The Baud rate may be changed by issuing a [Set Data Variables](#)^[3] command to the VNC1L after establishing communication at 115200 Baud.

Also, the VNC1L UART requires the use of RTS/CTS flow control. If the MCU UART does not automatically handle hardware handshaking, this must be implemented in the MCU firmware.

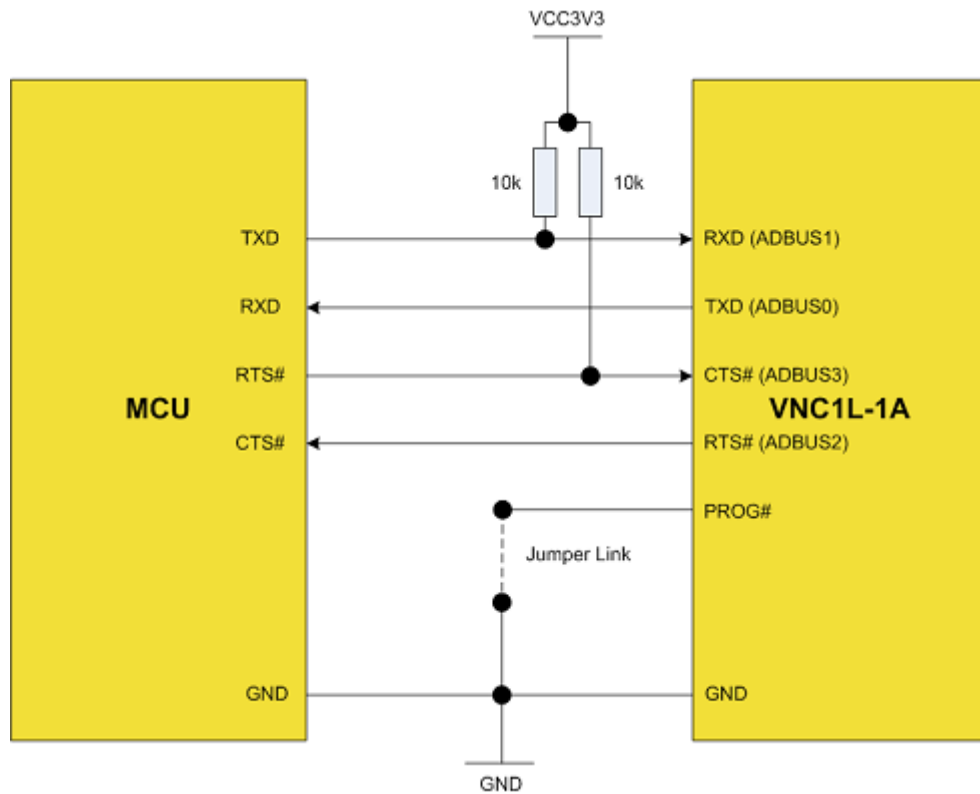
As with the FT232R [programming the VNC1L over USB](#)^[9], it is possible to use two of the available MCU IOs to control the PROG# and RESET# pins from the MCU firmware. The following diagram illustrates this arrangement:



To enable the bootloader, the PROG# pin must be driven low and the VNC1L must then be reset by driving the RESET# pin low then high. Run mode can be enabled by driving the PROG# pin high and then resetting the VNC1L by driving the RESET# pin low then high.

In a situation where IOs from the MCU are not being used to control the PROG# and RESET# pins, a jumper must be used to manually enable program or run mode. A sample block diagram of the hardware requirements for programming from an MCU with a jumper controlling PROG# is shown below:

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Note that for the bootloader to be active the jumper must be fitted before powering the VNC1L. If the jumper is not fitted, the VNC1L will power up in run mode with the bootloader inactive.

Programming the VNC1L from an MCU will require firmware development to allow Flash programming.

5 Revision History

Version	Release Date	Comments
1.0	September 2006	Initial release.
1.1	September 2006	Typo correction and synchronisation reorder.
1.2	October 2006	Added statement for pseudo code not including error recovery. Added reference to AN232R-01 for CBUS Bit Bang mode. Added #s to RTS and CTS signals in diagrams.
1.3	November 2006	Changed 128 byte recommendation for Write Flash Block and Read Flash Block to a requirement.

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